CLAIMS

What is claimed is:

1. An improved internal combustion engine of the type having at least one combustion chamber coupled to at least two valves, the at least two valves comprising at least one intake valve and at least one exhaust valve, wherein operation of the at least two valves is controlled in part by operation of a fixed timing mechanism, the improvement comprising:

a valve actuator, operatively coupled to at least one valve of the at least two valves, for controlling operation of the at least one valve independent of the fixed timing mechanism,

wherein the valve actuator is controllable to regulate engine gas flow.

2. The improved internal combustion engine of claim 1, wherein the valve actuator comprises a pressure-actuated piston, the improved internal combustion engine further comprising:

a source of pressurized hydraulic fluid; and

a fluid control valve operatively coupled between the source of pressurized hydraulic fluid and the pressure-actuated piston,

wherein operation of the fluid control valve regulates application of the pressurized hydraulic fluid to the pressure-actuated piston to control operation of the pressure-actuated piston.

3. The improved internal combustion engine of claim 2, further comprising digital control means, coupled to the fluid control valve, for controlling operation of the fluid control valve.

4. The improved internal combustion engine of claim 1, further comprising digital control means, coupled to the valve actuator, for controlling operation of the valve actuator.

5. The improved internal combustion engine of claim 1, wherein the valve actuator further comprises a limiter for limiting a range of operation of the at least one valve.

6. A diesel engine comprising the improved internal combustion engine of claim 1.

7. The improved internal combustion engine of claim 1, wherein the valve actuator is controllable to effectuate variable levels of internal exhaust gas recirculation.

8. An internal combustion engine comprising:

at least one combustion chamber;

at least two valves coupled to the combustion chamber, the at least two valves comprising at least one intake valve and at least one exhaust valve, wherein operation of the at least two valves is controlled in part by operation of a fixed timing mechanism;

a valve actuator, operatively coupled to at least one valve of the at least two valves, for controlling operation of the at least one valve independent of the fixed timing mechanism;

a turbocharger comprising:

a turbine coupled to a compressor;

an input port operatively positioned to receive exhaust gases from the combustion chamber via the at least one exhaust valve to thereby drive the turbine and the compressor; and

an output port operatively positioned to provide pressurized air received from the compressor to the combustion chamber via the at least one intake valve,

wherein the valve actuator and turbocharger are controllable to regulate engine gas flow.

9. The internal combustion engine of claim 8, wherein the turbocharger comprises a variable nozzle turbocharger.

10. The improved internal combustion engine of claim 8, wherein the valve actuator further comprises a limiter for limiting a range of operation of the at least one valve.

11. A diesel engine comprising the internal combustion engine of claim 8.

12. The internal combustion engine of claim 8, wherein the valve actuator and turbocharger are controllable to effectuate variable levels of internal exhaust gas recirculation.

13. In an internal combustion engine having at least one combustion chamber coupled to at least two valves, the at least two valves comprising at least one intake valve and at least one exhaust valve, wherein operation of the at least two valves is controlled in part by operation of a fixed timing mechanism, a method for effectuating internal exhaust gas recirculation, the method comprising:

operatively coupling a valve actuator to at least one valve of the at least two valves;

controlling operation of the at least one valve via the valve actuator independent of the fixed timing mechanism to regulate engine gas flow.

14. The method of claim 13, wherein the valve actuator is coupled to the at least one intake valve, and wherein controlling operation of the at least one valve further comprises advancing opening of the at least one intake valve.

15. The method of claim 13, wherein the valve actuator is coupled to the at least one intake valve, and wherein controlling operation of the at least one valve further comprises retarding closing of the at least one intake valve.

16. The method of claim 13, wherein the valve actuator is coupled to the at least one exhaust valve, and wherein controlling operation of the at least one valve further comprises advancing opening of the at least one exhaust valve.

17. The method of claim 13, wherein the valve actuator is coupled to the at least one exhaust valve, and wherein controlling operation of the at least one valve further comprises retarding closing of the at least one exhaust valve.

18. The method of claim 13, wherein the valve actuator further comprises a pressure-actuated piston, the method further comprising:

operatively coupling a source of pressurized hydraulic fluid to the pressure-actuated piston; and

regulating application of the pressurized hydraulic fluid to the pressure-actuated piston to control operation of the pressure-actuated piston.

19. The method of claim 13, wherein controlling operation of the at least one valve further comprises controlling operation of the at least one valve to effectuate variable levels of internal exhaust gas recirculation.

20. In an internal combustion engine having at least one combustion chamber coupled to at least two valves, the at least two valves comprising at least one intake valve and at least one exhaust valve, wherein operation of the at least two valves is controlled in part by operation of a fixed timing mechanism, and wherein a turbocharger is operatively positioned to receive exhaust gases from the combustion chamber via the at least one exhaust valve and to provide pressurized air to the combustion chamber via the at least one intake valve, a method for effectuating internal exhaust gas recirculation, the method comprising:

operatively coupling a valve actuator to at least one valve of the at least two valves;

controlling operation of the at least one valve via the valve actuator independent of the fixed timing mechanism to effectuate internal exhaust gas recirculation; and

controlling operation of the turbocharger to regulate engine gas flow.

21. The method of claim 20, wherein the valve actuator is coupled to the at least one intake valve, and wherein controlling operation of the at least one valve further comprises advancing opening of the at least one intake valve.

22. The method of claim 20, wherein the valve actuator is coupled to the at least one intake valve, and wherein controlling operation of the at least one valve further comprises retarding closing of the at least one intake valve.

23. The method of claim 20, wherein the valve actuator is coupled to the at least one exhaust valve, and wherein controlling operation of the at least one valve further comprises advancing opening of the at least one exhaust valve.

24. The method of claim 20, wherein the valve actuator is coupled to the at least one exhaust valve, and wherein controlling operation of the at least one valve further comprises retarding closing of the at least one exhaust valve.

25. The method of claim 20, wherein controlling operation of the turbocharger further comprises adjusting nozzle vane closure of the turbocharger.

26. The method of claim 20, wherein controlling operation of the turbocharger further comprises controlling operation of the turbocharger to effectuate variable levels of internal exhaust gas recirculation.